Picture Box Redux: New Perspectives on Pictorial Imaging

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Picture Box Redux: New Perspectives on Pictorial Imaging

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Abstract: Artists have used the Picture Box to solve problems of near and far perspectives in painting and drawing throughout history. Its development dates back thousands of years with elements of its evolution evidenced in Prehistoric rock paintings from Europe and Africa and Ancient Egyptian Bas relief. Picture Box elements have resurfaced at various times and in various art forms including Stage Design, Photography, Cinema, and Animation. Stage Designers represent far perspective on shallow platforms by positioning realistic props in front of painted backdrops. Photographers use depth of field to isolate foreground figures and blur background imagery. Film directors construct elaborate sets and choreograph complex camera movement to force perspective and point of view. Disney's horizontal multi-plane camera allowed two-dimensional images to be photographed in three-dimensional space. More recently, we have seen the Picture Box evidenced in Computer Graphics Imagery, (CGI) Objects viewed by virtual cameras are rendered in a pyramid-shaped volume known as a viewing frustum, which is structured in many ways, not unlike, the Picture Box. While technologies evolve and adapt, the Picture Box continues to provide a solution for representing near and far perspective in image making.

Keywords: Picture Box, Image Making, CGI, Animation, Moving Image, Photography, Painting

Introduction

PICTURE BOX REDUX explores the way in which artists have used the *picture box* to solve problems of near and far perspectives throughout history. Its development dates back thousands of years with its evolution evidenced in prehistoric rock paintings from Europe and Africa and ancient Egyptian bas relief. The picture box is an attempt to simulate human peripheral vision for pictorial composition in a wide variety of representational art forms. Similar strategies for the organization of three-dimensional space may be witnessed in a multitude of representational art practices including Stage Design, Photography, Cinema, and Animation.

This paper will look at the history and evolution of the picture box form from its earliest origins in prehistoric rock paintings to Egyptian bas relief to its fully developed form in painting from the early renaissance. It will explore similar compositional strategies at play in a wide variety of artistic mediums predicated by both artistic sensibilities and technological limitations. As new art forms emerge and older art forms converge and technological jargon is rapidly introduced, adapted and discarded, this paper explores the notion that a redux of the picture box terminology could be useful to interpret similar compositional strategies for the organization of three-dimensional space in a range of varied and complex artistic practices.

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The Picture Box

Although the term picture box is commonly used by both animators and illustrators, the author could find, but a single print reference to the term in Donald W. Graham's book, Composing Pictures, published by Hyperion in 1970. Graham studied engineering at Stanford University and later art at Chouinard's Art Institute in Los Angeles (Now amalgamated into the California Institute of the Arts), later becoming a member of the faculty. In 1932, he was hired by Walt Disney to deliver specialized instruction in line drawing and composition for Disney animators, as part of studio's gear up to its first feature film production, *Snow White and the Seven Dwarfs* released in 1937 (Thomas, 1995: 538).

The picture box method, as described by Graham, is an attempt to rationalize perceptions of the human experience of vision and apply these to the flat, rectangular surface of the picture. The technique has been used throughout history, with its origins evidenced in the earliest types of pictorial representation and evolving to its most elaborate examples in early renaissance painting. To understand the origins of the picture box, we must first consider the phenomenon of human peripheral vision, which may be defined as the environment that we see before us, not including, those areas too far to either side of us, too high above us, or too low below us; as these tend to blur and lose colour definition, before becoming imperceptible.

The included visualized area is often depicted as a cone of vision (O'Rourke, 1998), commencing at the viewer's eye position and extending towards a targeted location on the horizon and widening to encompass the maximum extent of the viewer's field of view. If the base of this imaginary cone is restructured as a rectangle in order to relate it to the picture structure, the cone of vision then becomes a pyramid, and if within this pyramid, we estimate a range between the viewer and the horizon, defined by the near and far limits in which objects may appear in sharp focus, then we are left with a box-like structure, sitting in single-point perspective, within which, as Graham points out, "true measurements can be suggested convincingly" (Graham, 1970). Graham refers to this area as the picture box. [Figure 1]

Historical Perspectives

Graham uses the term picture box to describe a composition technique which evolved over thousands of years as may be seen in some of the earliest known examples of picture making, such as those found in prehistoric cave paintings, such as those in Lescaux, France which date from between 10,000 and 15,000 B.C. As free drawings or vignettes, these examples suggest unlimited depth (Graham, 1970), unrestricted by the found surfaces upon which they were made.

Graham suggests that it was not until the advent of architecture that the problem of measuring depth became significant.

> The wall has always been a key to the understanding of pictures. How the artist accepts or rejects the wall as a limitation of graphic depth always affects his attitudes toward, and his concepts of, picture structure. (Graham, 1970 p.150)

Graham is of course referring to the rectangle surface of the interior wall and the effect it had on the composition of pictures made on its surface. He is suggesting that the rectangular

shape of the wall exerts a compositional influence on the structure of the picture; early examples of which may be evidenced in Egyptian art such as, Tjawet, Sole Companion to the King from 2280 B.C. [Figure 2]

Although the picture box is not yet fully realized at this early stage, Graham suggests that if one imagines the rear plane of the picture box moved forward, towards the viewer to within a very short distance of the front picture plane, this rear wall then functions as a sort of a backdrop or shutoff plane (Graham, 1970). The resulting shallow box affords the artist the opportunity to employ the effect of limited sculptural depth, known as bas-relief.

It was not, however, until the early renaissance that we saw the fully matured picture box technique applied to painting. In this example by Van Eyck from 1435, The Madonna with Chancellor Rolin, [Figure 3], the structural influence of the picture box is clearly visible. The accurately proportioned figures sit, in a structured interior space, beyond which, through a window, may be seen a landscape environment. This classic example of Sacre Conversazione painting applies conventions of near perspective, to the figures positioned in the room and far perspective for those elements of background imagery observed outside and beyond the structure of the room. Near perspective techniques, such as plan and elevation, are used to structure foreground elements; whilst far perspective techniques, such as overlapping planes and tonal lightening, are applied, beyond the picture box area.

The painting exemplifies the way in which the picture box technique affords the artist the opportunity to place foreground figures in intimate proximity of each other, whilst distant elements to the rear of the composition place these same figures in the wider context of environment.

Stage Design

Similar compositional objectives to those of concern to the painter seem to be at play in other art forms of as well, and the resulting picture box-like solutions seem to indicate that these concerns are concerns based on human visual perception and its reproduction in representational art.

In theatrical performance, presentational space, refers to that space occupied by actors, scenery and objects (McKinney, 2009) and scenographers are concerned primarily with the organization of this space. Even the largest productions, require scenography which balances intimate proximity of audience to actors (near perspective), the need to depict the play in a wider context of environment (far perspective) and to contain the entire production within the limited space of the theatre.

Writing in 1902, Adolphe Appia, expressed his frustration, with the then, current trend for the use of elaborately, painted sets as an illusion of real space, (McKinney, c2009) when he writes:

> Our present stage scenery is entirely the slave of painting-scene painting-which pretends to create for us the illusion of reality. But this illusion is itself an illusion, for the presence of the actor contradicts it. In fact, the principle of illusion obtained by painting on flat canvas and that obtained by plastic and living body of the actor are in contradiction. (McKinney, c2009, p.199)

Appia, felt that a unification of the scene elements of actor, prop and backdrop was necessary, and finding inspiration in Eurhythmics, a series of musical exercises developed by Jacques Delcroze, he began to develop his own idea of Rhythmic Space.

Historically, stage designers had represented near and far perspective by positioning props and actors in front of painted backdrops on shallow platforms, but Appia felt that there was an inherent conflict in this strategy, between the real bodies of the actors, and the elaborately painted environments depicted on the backdrops. Like the picture box, Appia's rhythmic space was an attempt to unify the foreground, near perpective elements of actor and prop with the backround, far perspective elements of the presentational space of the stage. In the application of his ideas, Appia used architectonic mass in the form of steps, platforms, pillars and walls, to accentunate the three-dimensionality of the stage area (McKinney, c2009). He modelled the actors in light and grounded them with shadow and he simplified the backdrop to an almost abstract element.

In Appia's designs for Orpheus and Eurydice, [Figure 4] we can see the structure of the picture-box emerge in the presentational space of the theatre. The architectonic elements of scenography, provide a structured interior space in which to place the three-dimensional figures of the the actors in near perspective, accentuated by light and shadow. The simplified backdrop, now unified with the other scene elements, acts as a shut-off plane to limit far perspective.

Lens-based Media

Photographers, too, use a picture box-like technique to organize perceived three-dimensional space in image capture strategies, but it is the technical limitations of the lens, and specifically the lens's depth of field, which provides the opportunity. Although the camera view is often illustrated as a pyramid commencing with the lens of the camera and progressing towards the horizon, in actuality, O'Rourke's cone of vision seems a more apt description of what the camera sees since the camera lens is based on the lens of the eye. The imaging plane of the camera captures a rectangular portion of that cone of vision producing a similar compositional effect to Graham's picture box structure.

Since the limits of the lens's depth-of-field may be described as "the distance between the nearest and furthest parts of a subject that can be imaged with acceptably sharp detail at one focus setting of the lens" (Langford, 1986), then we could, perhaps, draw a parallel, between the limits of lens depth-of-field and the near and far planes of the picture box. For within this range, just like within Graham's picture box, imaged subjects may be composed in clarity and focus. Photographers use this technological phenomenon to their advantage, by keeping close, near-perspective subjects in focus and positioning background elements in the out of focus range, defined by the depth-of-field of the camera lens. In this way, out of focus picture elements tend to blur, producing a textural backdrop, which gives the effect of a shutoff plane and thus limits problems of far perspective. This textural backdrop, in it's out of focus abstraction, serves a similar function to the simplified backdrop of Appia's stage providing the photographer with a rhythmic space in which to compose her subject.

The application of the picture box method may be seen in cinema technique as well, combining both the staging and the lens-based considerations explored above. Hitchcock's Rope (1948) provides an interesting example, notable both for its elaborate set designs and the application of real-time filming technique. In his book, *The Architecture of Image: Existential*

Space in Cinema, author Juhani Pallasma compares Hitchcock's Rope to Van Eyck's The Madonna with Chancellor Rolin (c. 1435), noting that both exhibit an engagement with "the duality of the focused interior and the distant view" (Pallasma, 2007 p.50) and citing the applied scenography in Rope as a cinematic reference to the early renaissance painting. Pallasma's focussed interior relates conceptually both to Appia's rhythmic space and Graham's picture box. Both Van Eyk's painting and Hitchcock's film separate foreground figures in near perspective from background imagery, in far perspective, by an interior, room-like structure. [Figure 5]

That the background element in the Hitchcock film is a model suspended beyond the rear wall of the set and those in the painting are rendered on Van Eyck's canvas in pigment is inconsequential, since both provide picture box solutions to the organization of near and far perspective in representational space.

Animation

When Disney released The Old Mill in 1937, scenes filmed using Disney's innovative vertical multi-plane camera were seen for the first time. As part of the gear up towards to feature film production, the short provided a testing ground for the new technology. The device allowed multiple layers of two-dimensional sequential artwork to be photographed in actual three-dimensional space, in a large vertical, stage-like, structure, resembling, in many ways, a physical embodiment of the picture box.

As well as Disney, other animators had experimented with multi-plane camera setups and as early as 1923, German animator, Lotte Reiniger, improvised one such arrangement in her production, "The Adventures of Prince Achmed." She described the device as follows: "...the whole contraption looked like a four poster bed, the camera being supported by sturdy wooden beams..." (Russet, 1988). Using this setup, Reiniger would animate character elements on one level, while effects animator, Berthold Bartosh worked on another level. Foreground elements could be isolated on a top level, whilst background elements would be photographed on a bottom level.

Former Disney animator, UB Iwerks, had, in fact, built a rudimentary multi-plane camera system as early as 1932, in the basement of his studio, with "...parts of an old Chevy..." (Culhane, 1986) and costing in the region of $350.00. Unlike the vertical setup of the Disney camera, this device was structured horizontally with its camera, fixed in place (Maltin, 1980 p.196). Disney's device was distinct from these earlier prototypes, by both the complexity of its engineering and the staggering development cost of over $70,000.00 (Maltin, 1980), £1.5M in today's currency. The frame of the camera, allowed up to six, independently lit picture elements, to be placed as far as 14 feet away from the lens, maximizing the depth-of-field. [Figure 6]

According to Frank Thomas, the complexities of the "multi-plane" were not limited to its development: "There was also a time factor in just shooting the film; to get the depth of field in the focus for such a distance, a time exposure of some eight or nine seconds was required for every frame of film" (Thomas 1981, p.309). Structurally though, Disney's device was a large, physical, picture box. Layers of artwork were positioned inside the real space of the camera stand interior, just as figures and object elements in renaissance painting were composed in the near perspective stage area of the picture box structure. Background elements, photographed on the bottom most layer of the multi-plane camera, functioned as a shutoff

plane to limit far perspective in the resulting pictorial imagery of the animated film; just as the distant landscape elements in the historic painted examples, were rendered flat on the rear plane of the underlying picture box structure.

Computer Graphics Imagery

More recently, we have seen the Picture Box evidenced in Computer Graphics Imagery (CGI), as a method for dealing with the organization of virtual representational space.

The way in which CGI cameras see the field of view, and how computers manage the rendering of objects placed within it, are subject to similar concerns and aesthetics as those examples seen in the other related mediums. The CGI camera, is an attempt to simulate the human field of vision, for digital rendering; just as the picture box, is an attempt to simulate human peripheral vision for pictorial composition.

CGI objects viewed by virtual cameras are rendered in a pyramid-shaped volume known as a viewing frustum. Near and far clipping planes define the extent of the area to be rendered. Rendering limits must be applied to prevent the software program from attempting to render, "the infinite space of an endless Cartesian coordinate system" (O'Rourke, 1998). Just as the picture box defines the near and far limits in which objects may appear in sharp focus in a painting, the frustum defines the near and far limits in which objects may be rendered in CGI. We may see parallels in the structure of this area with not only the picture box, but the presentational space in scenography and the limits of lens depth-of-field in photography.

Cubic environment mapping is another aspect of CGI rendering which offers a structural parallel to the picture box. Ned Green, a computer scientist at the New York Institute of Technology, first proposed the theory in 1986. He proposed that a virtual camera could be placed at the center of a cubic primitive, upon the interior six sides of which, linked image textures of a sky, could be projected. Green's example of one such linked image texture may be seen in Figure 7. As may be seen in the example, six square image textures, are arranged in a "T" shaped pattern, surrounded by a non-rendering black border region. When this image map is applied to the interior surface of the cubic primitive, all rendered views link to each other to form one three-dimensional whole.

In his paper, "Environment Mapping and Other Applications of World Projections", Greene almost seems to be describing a CGI version of the picturebox when he says:

> A world projection of the distant environment centered at a typical camera position can be used to render distant objects in the scene, while the near environment is rendered from three-dimensional models at each frame and then composited with the distant environment. (Greene, 1986)

So similar to the picture box, Greene's two-pronged approach to CGI rendering consists of compositing "distant environment" textures with "three-dimensional models", just as renaissance painters combined approaches for representing far and near perspective elements in pictorial compositions.

Conclusions

While technologies evolve and adapt, evidence seems to show that a range of strategies similar to the Picture Box continue to provide solutions for the organization of three-dimensional space in a wide variety of representational art forms. In all cases, a similar Two-pronged approach is applied which combines near and far elements into an integrated composition.

As surfaces have evolved from cave interiors to architectural walls, from paintings to screen, the rectangular structure of the picture continues to have a profound influence on composition and picture box-like solutions continue to be employed in the many and varied art practices which have followed, as a mediation of human visual perception. The problem of formatting the human cone of vision into a pyramid, in order to relate it to the rectangle of the painting or screen or the box of the stage, requires the necessary application of a structural solution, balancing near and far subject elements in a complete representational environment. Technological limitations of perspective drawing, stage size, lens depth-of-field and rendering algorithms, have necessitated discreet solutions for painting, scenography, photography and CGI.

Recognizing the similarities in this approach is made more difficult when each discipline has evolved a very specific vernacular to describe the parameters of its own structural composition. This is further complicated by a proliferation of technological jargon, which is rapidly introduced, adapted and oftentimes discarded as new art forms emerge and older art forms converge at an alarming rate. In a world where galleries hang video screens alongside paintings; dramatics are performed in front of animated backdrops and virtual worlds host performance art, discipline specific vocabularies lie in a state of flux as mechanical-chemical terms such as film are replaced by video only to be replaced by streaming media in a few short years.

In this ecology of rapid change, a common vocabulary for describing compositional strategies is necessitated not only to replace defunct terminology, but to support converging and emerging media. A redux, therefore, of Graham's picture box could contribute to a common vernacular for pictorial composition in a range of varied and complex artistic practices.

Figures

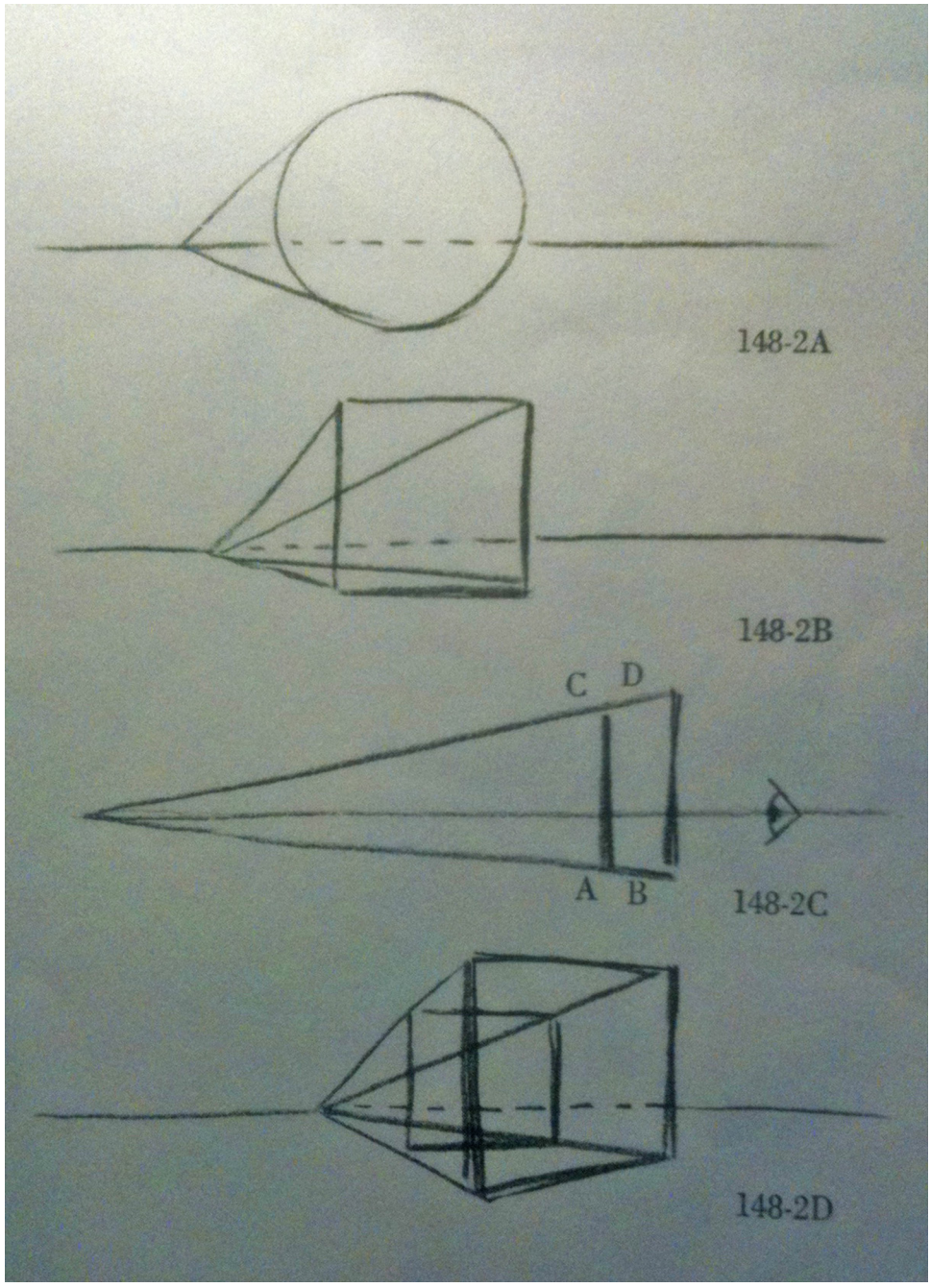

Figure 1: (Graham, 1970) Graham's Sketches of the Picture Box Structure

Figure 2: (Graham, 1970) Tjawyet, Sole Companion of the King (ca. 2280BC) Seattle Art Museum: Stimson Collection

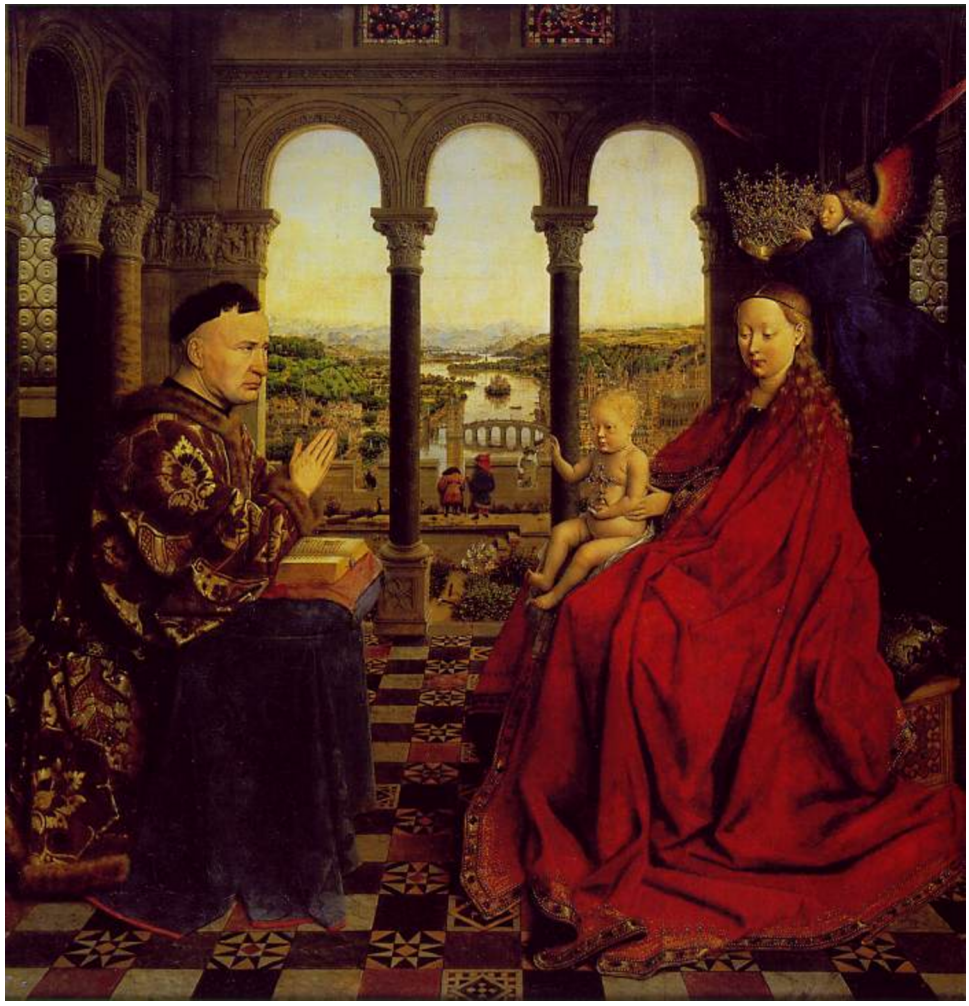

Figure 3: (Pallasmaa, 2007) Jan Van Eyck, The Madonna with Chancellor Rolin. (c. 1435) Museum of the Louvre, Paris

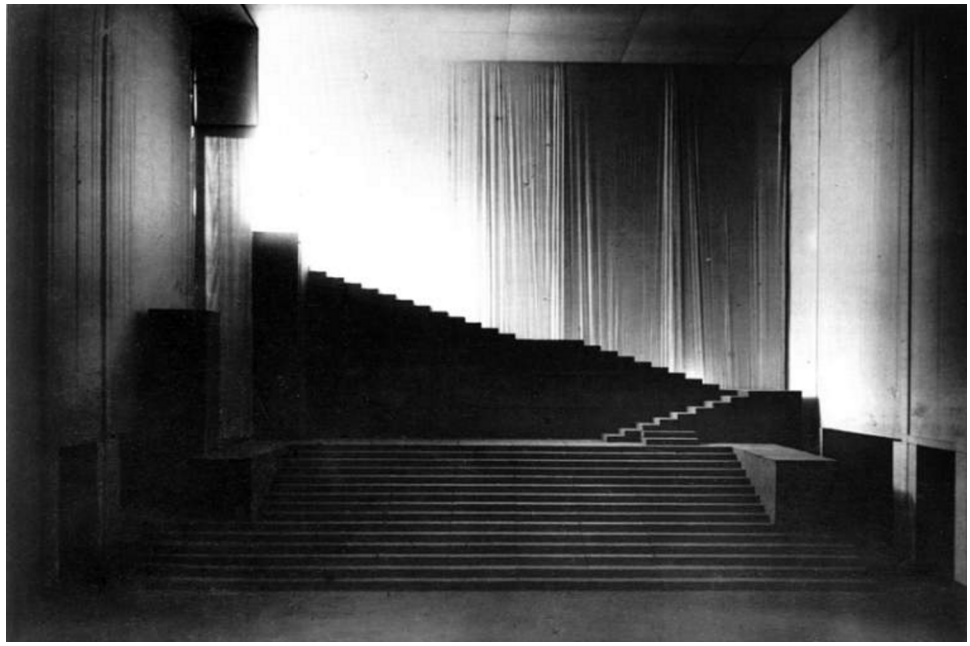

Figure 4: (McKinney, c2009) Adolphe Appia, Stage Design for Orpheus and Eurydice Photograph by C.W.Gluck, Hellerau, Jaques-dalcroze Institute, 1912–13

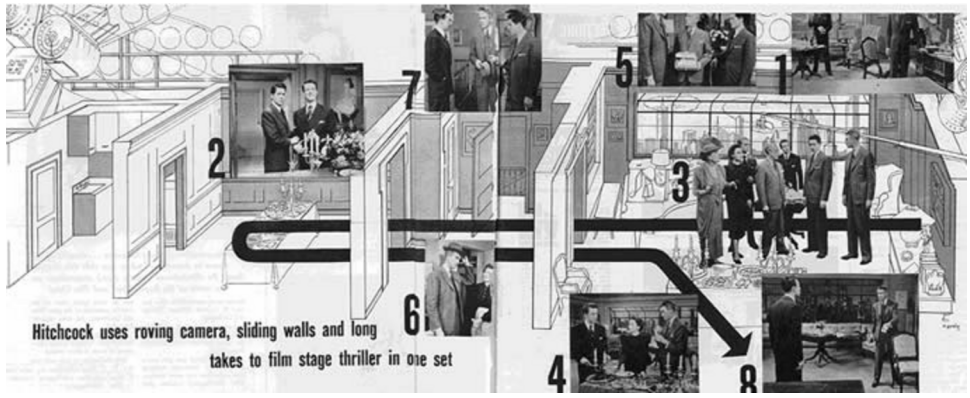

Figure 5: Scenographic Diagram from September 1948 Issue of Look Magazine on the Making of Hitchcock's *Rope*

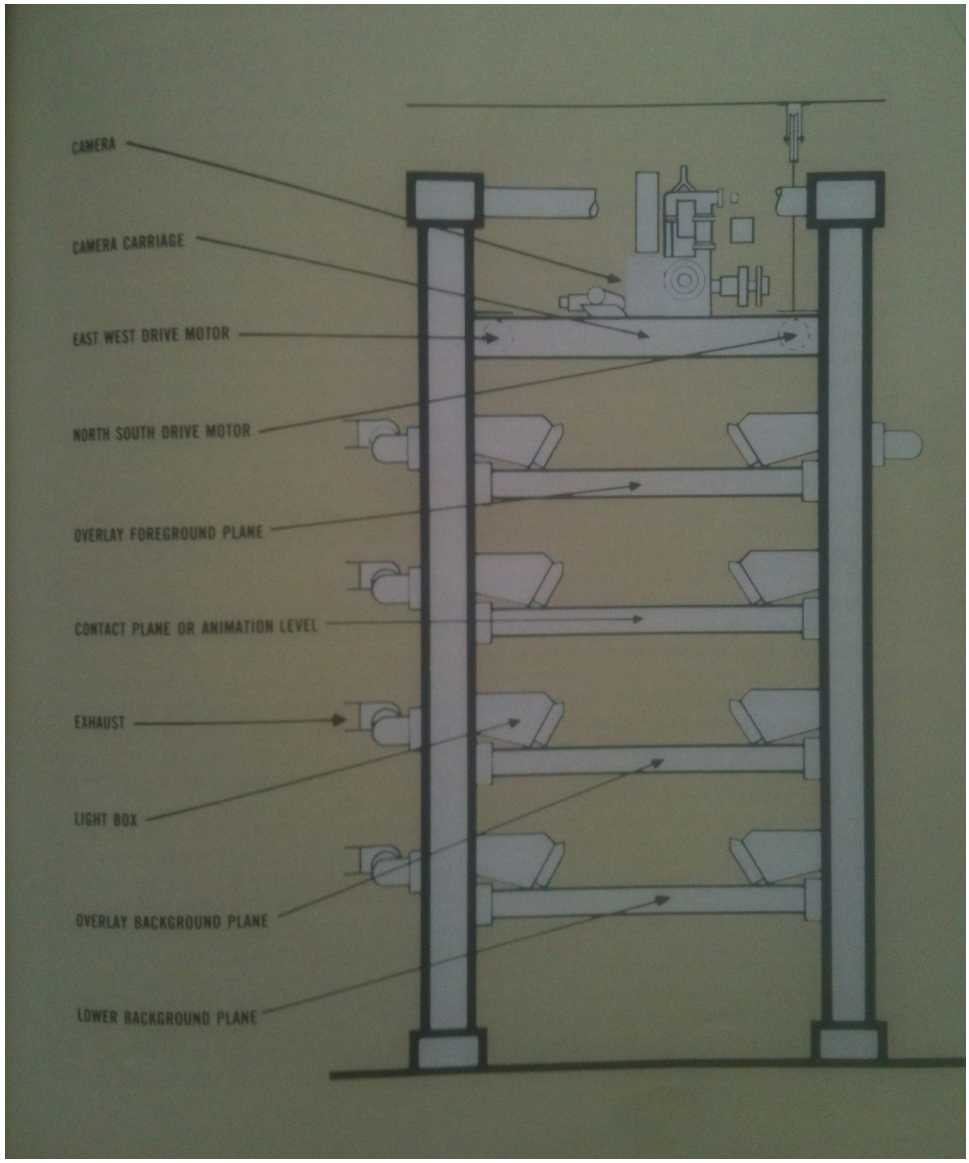

Figure 6: (Thomas, 1995) Diagram of Disney's Multi-plane Camera

Figure 7: (Greene, 1986) Cubic Environment Map

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Lee Cadieux, originally from Canada, holds the post of Lecturer in Animation in the Faculty of Arts, School of Creative Arts, University of Ulster. His academic career follows a 20 year career in Animation and Film Production and he has worked extensively on Animated features, TV series, video games and television commercials in the roles of Animator, Director, and Special Effects Artist. He has worked for Disney, Warner Bros., Nelvana, and DIC, in Canada, China and the UK. He was Subject Director for Design and Course Director of the BDes Design and Communication programme from 2003 to 2009 and is currently concentrating on research and teaching. He is an active member of the Research Institute for Art and Design, and his research interests include practice-based work in Animation, Performance and Interactive Technologies.

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